# PATENT SPECIFICATION

**594,051**

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COMPLETE SPECIFICATION

## Improvements in or relating to Method of Constructing Joints in Trusses made of Structural Tubes, and Metal Tubes for such Constructions

I, HENRY FIERZ, of Buochs, Nidwalden, Switzerland, a citizen of the Republic of Switzerland, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

The present invention applies to the manufacture of joints of structural trusses composed of metal tubes, such as are used in constructional scaffolding, the manufacture of airplanes and the like. The manufacture of such joints, as practised heretofore, presented a variety of constructional difficulties, which one tried to overcome by using machined connecting pieces to be secured to the tube by means of screws, rivets or pins. In another method of constructing such joints, the joint ends of the tubular elements were pressed or upset into quadrilateral shape and secured to gusset plates applied to one side thereof by means of screws or rivets. In still another form of construction, the tube ends were slotted, pressed or forged flat and welded together to form a gusset plate to which the connecting pieces were secured. The latter method is only suited for materials which can be welded, since a simple flattening of the tube, without slotting and inter-welding, would result in overstressing the material due to the extremely sharp bends produced in the tube wall.

All these prior methods, moreover, show additional disadvantages in view of the space required or of a lack of strength of narrow interconnecting straps.

The construction method defined in the present invention avoids these difficulties inasmuch as the tube ends are being pressed together laterally only in a limited sense, due to the reaction offered by mandrels disposed therein and which are removed after the joint-portion has been formed. These mandrels are of circular section and only permit of pressing the marginal tube wall-sections into a bulb-form, while the central tube-wall section may be fully flattened as it is not backed by such a mandrel. It is obvious that such a partial deformation of the tube end does not materially weaken the tube-section.

The joint-forming portion of the tube is suitably deformed by cold or warm pressing and has a cross-section which comprises a central portion in which the tube-wall sections are pressed together flat, and a bulbed marginal portion on both sides of the said central portion.

The tube connections thus produced are distinguished by requiring only little room and by having a relatively high strength.

Joints may be made by interconnecting such deformed metal tubes and by connecting same to profiled bars, gusset plates and the like.

Embodiments of structural joints according to the present invention are shown in the annexed drawing, in which :—

Fig. 1 is a top view of a first embodiment of a joint having a deformed tube end,

Fig. 2 is a side view of Fig. 1,

Fig. 3 is a section on the line III—III of Fig. 1,

Fig. 4 shows the cross-section of the non-deformed tube,

Fig. 5 shows the cross-section of the partly deformed tube;

Fig. 6 illustrates a second embodiment in the form of a cross-brace joint intermediate of the tube ends, and

Fig. 7 shows a view of an embodiment in the form of an entire joint.

In the embodiment shown in Figs. 1—3, the joint is located at the end portion of the tube 1. The latter, initially of circular section as shown in Fig. 4, is first pressed together into the shape shown in Fig. 5. Two auxiliary filler bars 3, of circular section and shown in Figs. 1 and 2 by dash-and-dot lines, then are positioned in the marginal portions 2, and the pressing operation is continued until the said portions have been formed into beads or bulbs 4 and the intermediate portions 5 and 6 have been pressed flat to lie on top of each other. The fillers 3 then are withdrawn. The tube 1 is secured to the gusset plate 8, e.g. by rivets 9, with its flat

side 7 which is laterally surmounted by the marginal bulb portions 4.

In the embodiment according to Fig. 6 the joint is formed by interconnecting two tubes 1 and $1^1$, deformed as described above intermediate of their ends. In making such a cross-brace stiffening joint, one preferably uses flexible steel cables in place of the rigid filler bars, which may be readily withdrawn after pressing.

In the embodiment according to Fig. 7, four tubular elements 1, $1^1$, $1^{11}$ and 1a are interconnected to form a joint by means of the gusset plates 10 and 11. The ends of the tubes 1, $1^1$ and $1^{11}$ are deformed as shown in Figs. 1—3, while the tube 1a is deformed intermediate of its ends in such a form that the marginal bulbs $4^1$ are made symmetrical relative to the plane of contact of the tube-wall sections $5^1$ and $6^1$.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is :—

1. A method of constructing joints in structural trusses composed of metal tubes, in which the tube section within the range of the joint is first pressed into kidney-shape and then so deformed in transversely applied compression which is controlled by means of round fillers, subsequently to be removed, introduced into the marginal portions of the tube cross-section, that the said marginal portions are formed into longitudinal bulbs, while the portions intermediate thereof are flattened into snug contact; said latter flat and doubled portion being used for structural interconnection with the other joint elements.

2. A joint-construction method as claimed in claim 1 for producing a joint-connection on the tube end, comprising the introduction of two filler bars of circular section into the marginal portions of the tube's preformed cross-section, and their removal after final pressing.

3. A joint-construction method as claimed in claim 1 for producing a joint-connection intermediate of the tube ends, comprising the introduction of flexible steel cables into the marginal portions of the tube's pre-formed cross-section, and their withdrawal after final pressing.

4. A metal tube adapted for constructing a joint in structural tresses composed of metal tubes having on its joint-forming portion a cross-section obtained by transverse compression, which cross-section comprises a central portion wherein the tube-wall parts are pressed together flat, and bulbed marginal portions adjacent said central portion.

5. A deformed metal tube as claimed in claim 4, in which one side of the joint-forming portion is flat, the marginal bulb portions projecting only on the other side of said portion.

6. A deformed metal tube as claimed in claim 4, in which the marginal bulbed portions are formed symmetrical to the plane of contact of the flattened tube-wall parts.

Dated this 25th day of June, 1945.
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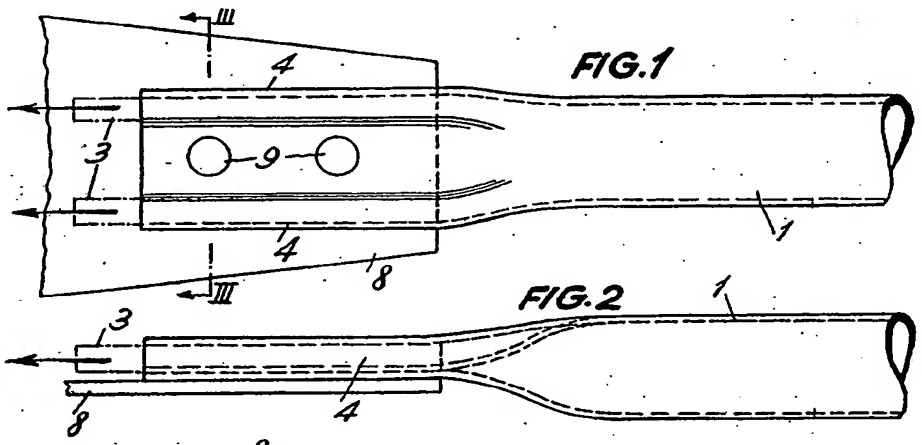


FIG.1




FIG.2

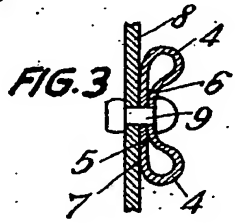


FIG.3

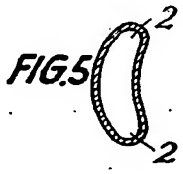


FIG.5

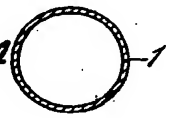


FIG.4

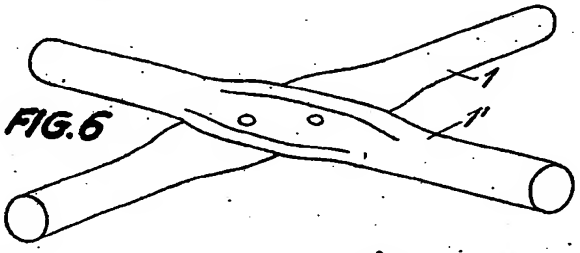


FIG.6

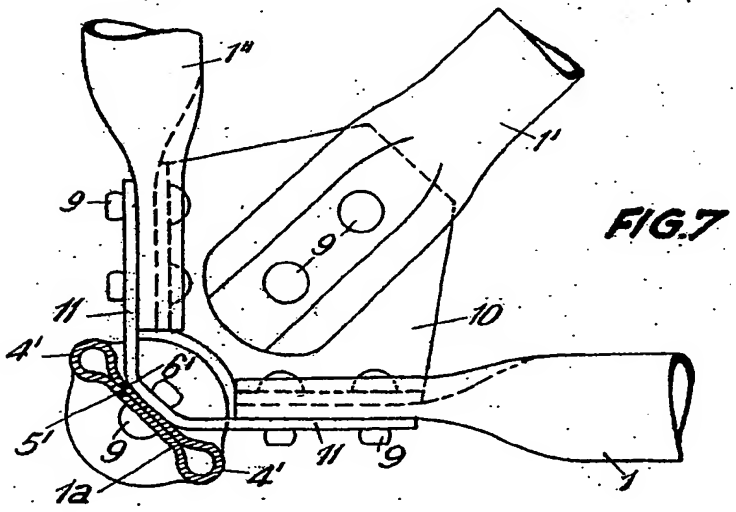


FIG.7

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